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REMARKS

The Examiner's final Office Action mailed on April 18, 2007 has been received and its contents carefully considered.

Claims 4-19 are pending in this application. In this Amendment, Applicant is amending claims 4, 7-8, 11, and 18-19. For at least the following reasons, it is submitted that this application, as amended herein, is in condition for allowance.

In the Office Action, the Examiner objects to Fig. 1 of the drawings on the grounds that it should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. A corrected drawing that includes the suggested legend, and labeled "Replacement Sheet," is attached at the end of this Amendment. The Examiner's review and approval of the corrected drawing is respectfully requested.

In the Action, claims 4, 7-8, 11 and 18 are rejected under 35 U.S.C. §102(b) as being anticipated by Emerson et al. (U.S. Patent No. 6,173,341). The rejection is respectfully traversed.

Regarding independent claim 4, the Examiner points to Emerson as disclosing a method of fault recovery in a computer system having a system processor (Fig. 2, element 102), an input/output processor (Fig. 2, element 210), and an input/output adaptor (Fig. 2, element 114), connected to the system processor and the input/output processor (Fig. 2), the input/output adapter being configured to be dynamically switchable between being controlled by the system processor and being controlled by the input/output processor (column 8, lines 30-54), the method for fault recovery comprising: detecting a fault in the input output processor; and switching the input/output adapter to control by the system processor if the input/output adapter is being controlled by the input/output processor when the fault is detected (column 8, lines 30-54).

The Applicant respectfully disagrees. Anticipation, under 35 U.S.C. §102, requires that each element of the claim in issue be found in a single prior art reference, and that all limitations of the claim must be found in the same reference. The Emerson patent is directed to a computer system with an Intelligent Input/Output architecture that provides a "plug and play" control mechanism for assignment and control of one or more input/output adapters (IOA's) by an input/output processor (IOP) (see Abstract). As shown in Figure 2 of Emerson and discussed in the text referenced by the Examiner, the

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IOA slots on an I/O bus are assigned by default at system initialization to an IOP (Fig. 4, step 402). If an IOA is detected in a particular slot (Fig. 4, step 404), then the IOA will become controlled by the IOP if a suitable driver module is downloaded for the assigned IOA and detected to be present (Fig. 4, step 406). If there is no suitable IOP executable driver module for the assigned adapter, then, optionally, a determination may be made that there is an appropriate host driver module available (Fig. 4, step 414), and a determination made to assign the IOA to host (system processor) control (Fig. 4, step 416). Emerson notes that in some alternate embodiments, the system configuration software may be explicitly invoked to release or unassign the IOA by a suitable message to the IOP prior to the establishment of host control.

As initially noted, the purpose of the invention in Emerson is to automate the assignment and control of IOA's by an IOP serving the I/O slots into which the IOA's are installed. Emerson discloses that control of an IOA by the host (system processor) is an available fallback in the event no suitable IOP executable driver module can be found for the assigned IOA. However, it is respectfully submitted that Emerson fails to teach or suggest the method of fault recovery recite in Applicant's claim 4, which comprises "detecting a fault in the input/output processor," and then "switching the input/output adapter to control by the system processor if the input/output adapter is being controlled by the input/output processor when the fault is detected." Emerson makes provision for detecting the presence or absence of a "suitable IOP executable driver module", but fails entirely to discuss the need for detecting a "fault" (i.e., a failure or malfunction, see application page 7, line 20) in the IOP and taking appropriate corrective action to maintain the operation of the IOA's served by the faulty IOP.

For essentially the same reasons, Applicant submits that the text in Emerson referenced by the Examiner (column 8, lines 30-54) fails to disclose that when there is a plurality of IOA's, "each of the dynamically switchable input/output adapters being controlled by the input/output processor when the fault is detected is switched to control by the system processor," as recited in claim 7.

Further, Emerson fails to disclose "detecting correction of the fault in the input/output processor; and switching the input/output adapter back to control by the input/output processor when the correction of the default is detected, if it was previously

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switched to control by the system processor as a result of the fault in the input/output processor" (emphasis added), as recited in claim 8, or when there is a plurality of IOA's, "each of the dynamically switchable input/output adapters being controlled by the system processor when the correction of the fault is detected is switched to control by the input/output processor if it was previously switched to control by the system processor as a result of the fault in the input/output processor," as recited in claim 11. It is submitted that Emerson does not address the issue of correcting a failure or malfunction in an IOP or detecting when such a correction is made so that the IOA's can be reassigned to the IOP.

Claim 18 depends from independent claim 4, and should therefore also be allowable.

In the current Office Action, the Examiner responds to the foregoing arguments (see Office Action, page 9) by noting that not finding a suitable input/output processor executable driver module for an assigned input/output adapter makes the input/output processor unavailable, and takes the position this unavailability is an input/output processor fault condition that is detected in Figure 4, element 414 (or should the Examiner be referring to element 406?).

The Applicant respectfully disagrees. The Applicant believes that the Examiner's construction of the term "fault," as applied to the input/out processor is overly broad and inconsistent with the language and intent of the application. As mentioned above, the present application specifically contemplates a method for "automatic fault recovery in the event of an IOP failure or malfunction" (application page 7, lines 20-21), clearly quite different from the "fault" condition postulated by the Examiner. Moreover, the Applicant submits that the unavailability of a suitable input/output processor executable driver module for an assigned input/output adapter is not an input/output processor "fault," per se, but rather a system "fault" because the necessary executable driver module is downloaded to the input/output processor, presumably by the system processor, when the input/output adapter is connected to the input/output processor (see Emerson column 8, lines 30-39) and is not inherently part of the input/output processor.

Without prejudice to the traversal of the Examiner's §102 rejection, the Applicant is amending claims 4, 7-8 and 11 to more distinctly claim the invention and thereby move

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the application more expeditiously toward allowance. Specifically, each of claims 4, 7-8 and 11 is amended by deleting the general term "fault" and substituting the more specific language "failure or malfunction," recited in the application. It is respectfully submitted that claims 4, 7-8 and 11, as amended herein, patentably distinguish over the applied Emerson reference.

In the Action, claims 5-6, 9-10, 12-17 and 19 are rejected under 35 U.S.C. §103(a) as being obvious over Emerson in view of Odenwald et al. (U.S. Patent No. 6,223,240). The rejection is respectfully traversed.

Regarding independent claim 12, the Examiner points again to Emerson as disclosing an input/output adapter which is configured to be dynamically switchable between being controlled by the system processor and being controlled by the input/output processor, but acknowledges that Emerson fails to disclose the claimed method for optimizing processor utilization. To overcome this deficiency in the base reference, the Examiner points to Odenwald as teaching a method for optimizing processor utilization in a computer system having a system processor (Fig. 7, element 702), an input/output processor (Fig. 7, element 718), and an input/output adaptor (Fig. 7, element 720), connected to the system processor and the input/output processor (Fig. 7), the method for optimizing utilization comprising: determining computer system utilization; and switching control of the input/output adapter from a first one of the system processor and the input/output processor to a second one of the system processor and the input/output processor, if it is determined that the first one of the processors is being over utilized and that the second one of the processors has sufficient capacity that switching control of the input/output adapter will not adversely affect system throughput (column 8, lines 2-15).

Applicant respectfully disagrees. The text in Odenwald referenced by the Examiner discusses an I/O architecture in which a primary IOP 606 forms a bridge between a primary PCI bus 604, to which host processor 602 is connected, and a secondary PCI bus 608 to which two secondary IOP's 614 and 616 are connected. Odenwald discloses that the primary IOP 606 includes an ISM (intermediate service module) for communication between the host processor 602 and IOP's 614 and 616. IOP's 614 and 616 maintain communication between the secondary PCI bus 608 and a

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fiber channel via the XOR engine 610 (a form of intelligent interface device). In addition, the XOR engine 610 is used by the ISM on the primary IOP 606. In this manner, notes Odenwald (column 8, lines 10-13), workload is split between two IOP's, rather than being processed by a single IOP, resulting in improved performance (emphasis added). A similar sharing of tasks between primary and secondary IOP's is disclosed with regard to the data processing system depicted in Figure 2 of Odenwald (column 4, lines 1-3).

Thus, the teaching of Odenwald is the sharing of I/O tasks between primary and secondary IOP's to improve performance in I/O architectures having primary and secondary busses. Contrary to the Examiner's position, Odenwald neither teaches nor suggests switching control of an input/output adapter between an input/output processor and the system processor for the purpose of optimizing processor utilization. Further, Odenwald fails to teach or suggest the important step of assessing computer system utilization, upon which the determination to switch control of the input/output adapter is based.

Regarding claim 13, the Examiner points to Odenwald (column 8, lines 2-15) as disclosing the limitation, "wherein switching control of the input/output adapter from the first one of the processors to the second one of the processors is further based on a determination that the over utilization of the first of the processors is likely to continue for at least a specified period of time." However, as noted above, the referenced text is limited to a discussion of sharing of I/O tasks between primary and secondary IOP's to improve performance in I/O architectures having primary and secondary busses. It is submitted that Odenwald fails to teach or suggest reassigning an IOA "based on a determination that the over utilization of the first of the processors is likely to continue for at least a specified period of time," as claim 13 requires. Nor does the referenced text in Odenwald teach the further limitation "wherein the steps of determining computer system utilization and switching control of the input/output adapter based on such determination are repeated at intervals substantially equal to the specified period of time," as recited in claim 14. As earlier noted, Odenwald fails entirely to disclose any means or process for determining computer system utilization.

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In the current Office Action, the Examiner responds to the foregoing arguments regarding claim 12 by noting (Office Action, page 11) that communications between secondary IOPs and the primary IOP in Odenwald are set up such that the secondary IOPs see the primary IOP as the host processor (column 9, lines 23-25). But the same paragraph in Odenwald goes on to state: "This feature is provided in the depicted example by placing a host identifier in messages generated by the primary IOP and sent to the secondary IOP. In turn these messages are identified such that replies to these messages from the secondary IOP, which are directed to the host, are routed to the primary IOP for processing" (emphasis added) (column 9, lines 25-30). Thus, as the Examiner acknowledges (Office Action, pages 10-11), functionality normally performed solely by the IOPs on the secondary bus may be placed also within the primary IOP to split up workloads and increase performance of the data processing system. Although the primary IOP in Odenwald serves as a bridge from the secondary bus to the primary bus and the system processor, it is clear from a complete reading of the reference that Odenwald fails to teach or suggest that the system processor assumes control of any of the input/output adapters to offset the processing load on the IOPs, as claim 12 requires.

In response to the Applicant's arguments regarding claims 13 and 14, the Examiner further points (Office Action, page 11) to Odenwald as disclosing a data processing system (Fig. 2, element 200) that uses a standard architecture for intelligent input/output called the I₂O specification. Citing from Odenwald, the Examiner asserts that the I₂O architecture defines an approach to input/output in which low-level interrupts are offloaded from the CPU to I/O processors designed specifically to handle input/output. With support for message passing from between multiple independent processors, the I₂O architecture relieves the host of interrupt intensive input/output tasks, greatly improving input/output performance (column 4, lines 6-22). The Examiner asserts that Odenwald also discloses an intelligent input/output real time operating system (IRTOS) which is a special real time operating system designed to support high speed, low overhead input/output operations (column 5, lines 35-45). The Examiner fails to note that the cited paragraph also discloses that IRTOS is in the primary IOP scanning the secondary bus looking for adapters (column 5, lines 34-37).

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It is respectfully submitted that the text cited by the Examiner, rather than supporting the Examiner's position, actually supports the Applicant's contention that the system processor in Odenwald does not at any time assume control of any of the input/output adapters; that that role is relegated solely to the primary and secondary IOPs. Moreover, nothing cited by the Examiner in Odenwald (or in Emerson) teaches or suggests the important features of claims 12-14, namely: switching control of an input/output adapter between an input/output processor and the system processor for the purpose of optimizing processor utilization; assessing computer system utilization, upon which the determination to switch control of the input/output adapter is based; reassigning an input/output adapter based on a determination that the over utilization of the processor controlling the input/output adapter is likely to continue for at least a specified period of time, and; the steps of determining computer system utilization and switching control of the input/output adapter based on such determination are repeated at intervals substantially equal to the specified period of time. In fact, it is the Applicant's understanding that the assignment of an input/output adapter to a specific input/output processor in Odenwald is based on an a priori assessment of processor utilization and is not the dynamic process defined by the present claims.

In consideration of the foregoing, it is respectfully submitted that claims 12-14 patentably distinguishes over the applied Emerson and Odenwald references, whether considered individually or in combination. Further, Applicant believes claims 5-6, 9-10, 15-17 and 19 are allowable for at least the reason that they depend from independent claims 4 and 12, previously discussed.

In this Amendment, claims 18 and 19 are amended to change the phrase "interconnected via a bus" to "interconnected via a common bus" so as to further distinguish over the two bus system disclosed in Odenwald, as exemplified in Fig. 2.

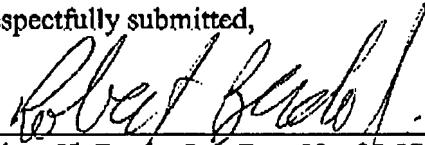
It is respectfully submitted that the application, as now amended, is in condition for allowance. Notice of allowance and the passing of the application to issue are respectfully solicited.

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If the Examiner believes that a conference would be of value in expediting the prosecution of this application, the Examiner is hereby invited to telephone the undersigned counsel to arrange for such a conference.

Respectfully submitted,



June 8, 2007

Date

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Attachment:

Replacement Drawing Sheet (Fig. 1)

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